

- Firms are sellers in product markets and buyers in factor (resource) markets.
- The demand for any resource is derived from the demand for the products that the resource can produce. Thus, resource demand depends on the price of the good or service that the resource produces and on the resource's productivity in producing the good or service.
- The demand curve for a resource in the short run is downward sloping because the marginal physical product (MPP) of additional inputs of a resource will decrease as a result of the law of diminishing marginal returns. In some textbooks, marginal physical product is called marginal product.
- A firm will continue to hire factors of production as long as its marginal revenue product (MRP) exceeds its marginal resource cost (MRC). A firm will not hire more resources once MRC exceeds MRP.
- The marginal revenue product curve for a firm selling its product in an imperfectly competitive market will be steeper than the marginal revenue product curve for a firm selling in a perfectly competitive market. The steeper slope results from both a decrease in the marginal physical product and a decrease in the product price required to permit the firm to sell a larger output.
- A firm maximizes total profits where a factor's marginal revenue product equals the factor's marginal resource cost. A firm maximizes total profit where $MRP = MRC$.
- In a perfectly competitive labor market, a firm can hire all the workers it wants at the current market wage. The firm will hire workers until the last worker's wage (MRC) equals the marginal revenue product of that last worker hired.

- When a combination of resources is employed in producing a good or service, the profit-maximizing rule is

$$\frac{MRP_a}{MRC_a} = \frac{MRP_b}{MRC_b} = \frac{MRP_n}{MRC_n} = 1.$$

- When a firm produces the profit-maximizing level of output, it must utilize a least-cost combination of resources. The rule for a least-cost combination of resources is

$$\frac{MPP_a}{MRC_a} = \frac{MPP_b}{MRC_b} = \frac{MPP_n}{MRC_n}.$$


- For a firm facing a perfectly competitive resource market, resource supply is perfectly elastic and equal to marginal resource cost at a market-determined price (wage) for the resource. Under monopsony or other imperfect conditions of employment, both resource supply and marginal resource cost are positively sloped curves with the marginal resource cost being a value greater than the price (wage) for all units beyond the first unit of the resource employed.
- Given a downward-sloping marginal revenue product curve and the differences existing between supply and marginal resource cost in perfect competition and monopsony, a monopsonistic employer will pay a lower price (wage) and hire fewer units of a resource than a perfect competitor.
- Economic rent is any payment to the supplier of a resource that is greater than the minimum amount required to employ the desired quantity of the resource.
- The equilibrium real interest rate influences the level of investment and helps allocate financial and physical capital to specific firms and industries.

- Profits are the return to entrepreneurs for assuming risk and for organizing and directing economic resources.
- Profits allocate resources according to the demands of consumers.

How Many Workers Should a Firm Hire?

You are the president of Acme Yo-Yo Company, a small manufacturing firm that produces Supersonic Yo-Yos, a popular toy that makes a “supersonic” noise when used.

- Acme yo-yos are produced by workers operating with two yo-yo-making machines. You have estimated how many yo-yos can be made using different numbers of workers and you must decide how many workers to hire to maximize your firm’s total profit.
- Acme is a perfect competitor in the product market. This means your firm can sell as many yo-yos as you want at the market price of a yo-yo.
- Acme also is a perfect competitor in the labor resource market. This means you can hire as many workers as you want at the market wage.
- You will hire each worker who adds more to your firm’s total revenue than he/she adds to your total cost. You will not hire a worker who adds less to total revenue than to total cost.
- Marginal physical product (MPP) is the change in your firm’s total output (Q) from adding an extra worker: $MPP = \Delta Q / \Delta L$, where L stands for labor.
- Marginal revenue product (MRP) is the change in your firm’s total revenue (TR) from adding an extra worker: $MRP = \Delta TR / \Delta L$. Because you can sell all the yo-yos you want at the market price (P), $MRP = (MPP)(P \text{ of a yo-yo})$.
- Marginal resource cost (MRC) is the change in your firm’s total cost (TC) from adding an extra worker: $MRC = \Delta TC / \Delta L$. Because you can hire all the workers you want at the market wage, $MRC = \text{Wage}$.
- The profit-maximizing rule for an employer is to hire the number of workers at which $MRP = MRC$. This means the employer hires those workers with $MRP > MRC$ and stops before hiring workers with $MRP < MRC$. (If this rule sounds familiar, it uses the same logic as the $MR = MC$ rule a firm uses to find its profit-maximizing amount of output.)

 **Student Alert:** Some textbooks use marginal factor cost (MFC) or marginal labor cost (MLC) instead of marginal resource cost (MRC).

Part A: Creating the Firm's Demand for Labor



Table 4-1.1

Productivity and Revenue Data for Yo-Yo Workers

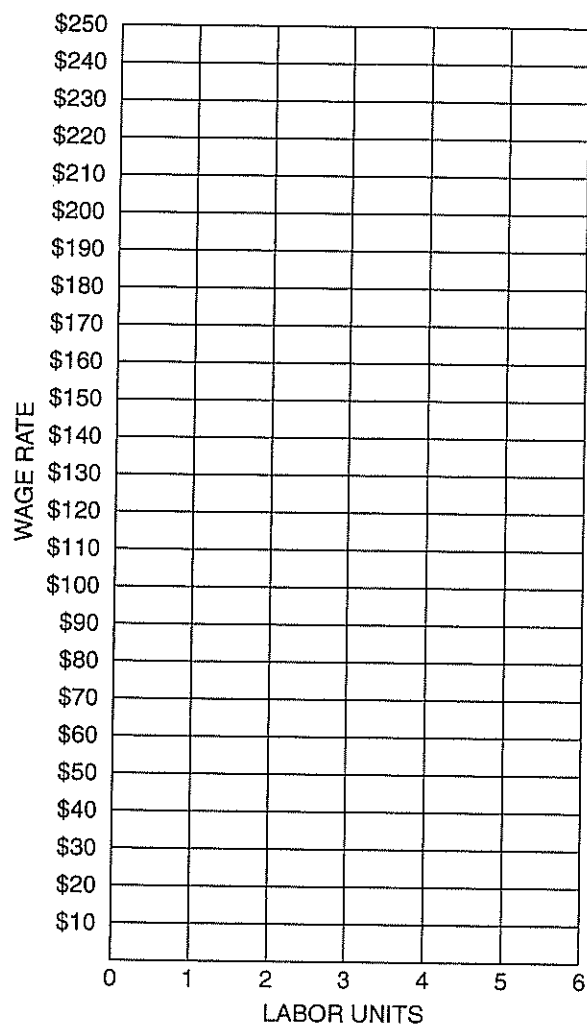
L (workers per day)	Q (yo-yos per day)	MPP	P	TR	MRP
0	0	—		\$0	—
1	20				
2	50	+30			+\$150
3	70		\$5		
4	85			\$425	
5	95	+10			
6	100				

1. Complete Table 4-1.1. Assume the market price of a yo-yo is \$5.
2. Why does the number of extra yo-yos produced by an additional worker decrease as more workers are added? Is it because the additional workers are less motivated and less talented than previous workers?
3. Plot the MRP values in Figure 4-1.1. Connect those values and label the curve as "MRP." Plot each MRP value on the higher of the two L values, not at the midpoint. For example, plot the MRP value of \$150 at L = 2 rather than at L = 1.5.



Figure 4-1.1

The Acme Firm's Demand for Labor and Supply of Labor



4. If the market wage is \$100 per worker per day, your firm can hire all the workers it wants at that wage. This means the supply of labor to your firm can be shown as a horizontal line at the wage of \$100. Draw a horizontal line in Figure 4-1.1 at \$100 and label the line as " $S_1 = MRC_1$." The MRC to the firm of each extra worker is equal to the wage of \$100.
5. At a wage of \$100, how many workers should your firm hire? Why?

4 Microeconomics

ACTIVITY 4-1 (CONTINUED)

6. Now assume the market wage drops to \$75. Draw a new horizontal line at that wage and label it as " $S_2 = MRC_2$." How many workers will be hired at the wage of \$75?
7. Finally, assume the market wage is \$50. Draw another horizontal line at that wage and label it as " $S_3 = MRC_3$." How many units of labor will be hired at the wage of \$50?
8. The firm's demand for labor shows how many workers it will hire at different wages. Complete Table 4-1.2 based on your work above.



Table 4-1.2

Acme's Demand for Labor

Wage	Number of workers hired
\$100	
\$75	
\$50	

9. If a firm hires labor in a perfectly competitive factor market, then the downward sloping portion of its MRP curve is its demand (D) curve for labor. If the wage is equal to the MRC, then by going to its MRP curve at a given wage, the firm finds the amount of labor where $MRP = MCL$. Go back to Figure 4-1.1 and label the MRP curve as " $MRP = D$."
10. Is the law of demand evident in Table 4-1.2? Why does a firm hire more workers when the wage decreases?

Part B: The Derived Demand for Labor

We saw in Part A that if a firm operates in perfectly competitive resource markets, its demand for labor is its MRP curve. So what can increase the firm's demand for labor? Remember how we calculate MRP if the product market is perfectly competitive: $MRP = (MPP)(\text{price of the good})$. An increase in the MPP of labor or an increase in the price of the good will increase the MRP of labor, thus increasing the firm's demand for labor.

A decrease in the marginal physical product or a decrease in the good's price will reduce the demand for labor.

11. In Table 4-1.3, indicate for each situation whether the product or labor market is being affected, whether the MPP of labor or the price (P) of the good will change, and whether the demand for labor will increase or decrease.



Table 4-1.3

Factors Changing a Firm's Demand for Labor

Situation	Which market?	Change in MPP?	Change in P?	Change in demand for labor
(A) A new yo-yo machine increases productivity of labor.	<i>Product / Labor</i>	<i>Yes / No</i>	<i>Yes / No</i>	<i>Increase / Decrease</i>
(B) The price of yo-yos increases.	<i>Product / Labor</i>	<i>Yes / No</i>	<i>Yes / No</i>	<i>Increase / Decrease</i>
(C) New government safety regulation reduces worker productivity.	<i>Product / Labor</i>	<i>Yes / No</i>	<i>Yes / No</i>	<i>Increase / Decrease</i>
(D) The demand for yo-yos decreases.	<i>Product / Labor</i>	<i>Yes / No</i>	<i>Yes / No</i>	<i>Increase / Decrease</i>
(E) New technology increases output of yo-yos.	<i>Product / Labor</i>	<i>Yes / No</i>	<i>Yes / No</i>	<i>Increase / Decrease</i>
(F) Consumers become tired of yo-yos.	<i>Product / Labor</i>	<i>Yes / No</i>	<i>Yes / No</i>	<i>Increase / Decrease</i>

The demand for any resource is called a *derived demand* because it is derived from the demand for the good or service that is produced by the resource. It is important that you understand the relationship between demand in the factor market and demand in the product market. (Even if you are a charming individual, unless you produce a good or service that is in demand, you will find it hard to land a good job.)

12. Assume that yo-yos become a hot fad and the increased demand for them drives the market price of a yo-yo up to \$8. Complete Table 4-1.4, which has the same productivity data as Table 4-1.1.



Table 4-1.4

Productivity and Revenue Data for Yo-Yo Workers

L (workers per day)	Q (yo-yos per day)	MPP	P	TR	MRP
0	0	—		\$0	—
1	20				
2	50	+30			+\$240
3	70		\$8		
4	85			\$680	
5	95	+10			
6	100				

13. Plot the new MRP data in Figure 4-1.1 and label it as " $D_2 = MRP_2$." Does this represent an increase in Acme's demand for labor? What caused it?

14. Based on your new MRP_2 curve in Figure 4-1.1, fill in Table 4-1.5.



Table 4-1.5

Acme's New Demand for Labor

Wage	Number of workers hired
\$100	
\$75	
\$50	

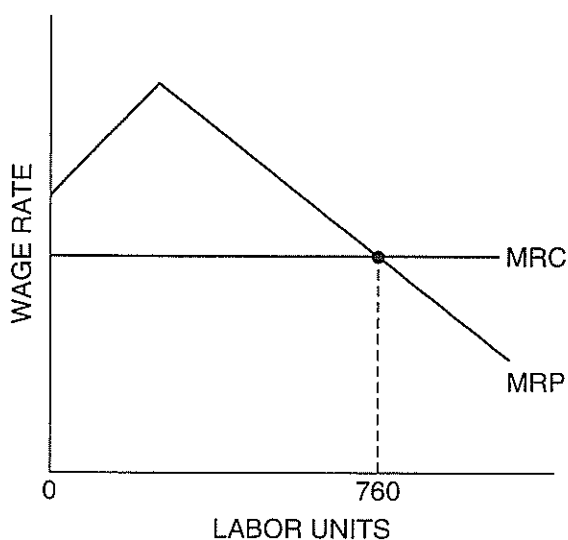
Part C: How Many Workers to Hire?

Figure 4-1.2 shows the MRP curve and the MRC curve for a company that sells its product in a perfectly competitive goods market and hires its labor in a perfectly competitive resource market.

15. You tell your friend that this firm should hire 760 units of labor because that is where $MRP = MRC$. Your friend is confused and asks how this firm can maximize total profit with 760 labor units since the marginal profit from the 760th labor unit appears to be \$0. Can you help your friend understand the logic of the $MRP = MRC$ rule?



Figure 4-1.2

Logic of the $MRP = MRC$ Rule

The Optimal Combination of Resources

In Activity 4-1, we assumed the Acme Yo-Yo Company was operating in the short run with a fixed amount of capital (equipment) and with labor as its variable resource. Let's now consider a long-run example where the firm can change its capital as well as its labor. What combination of labor (L) and capital (K) should the firm employ?

Part A: The Least-Cost Combination of Resources

What should a firm do if it wants to produce the most output possible from a given resource budget? What should it do if it wants to produce a given level of output at the lowest total cost? The approach to both of these problems is similar. The firm should allocate its resource budget between units of labor and units of capital in such a way that the following condition is satisfied, where marginal physical product is MPP and marginal resource cost is MRC:

$$\frac{MPP_L}{MRC_L} = \frac{MPP_K}{MRC_K}$$

If the resource markets are perfectly competitive, the price the firm pays for an extra unit of a resource is equal to its MRC. In that case the condition can be written as

$$\frac{MPP_L}{P_L} = \frac{MPP_K}{P_K}$$

where P_L is the price of a unit of labor and P_K is the price of a unit of capital.

Another way of stating this condition for *economic efficiency* is that the firm should get the same extra output from the last dollar spent on each type of resource.

Assume a firm has allocated its given resource budget between labor and capital and finds the marginal physical product for the resources to be 200 units from labor and 400 units from capital. That means the last unit of labor increased total output by 200 units while the last unit of capital increased output by 400 units. At first glance, you might think the firm should move some money away from labor and over to capital. But that would totally ignore the prices of the two resources. Assume the prices of labor and capital in competitive resource markets are \$10 and \$40, respectively.

1. Calculate the "MPP per \$1" for each resource.
2. Based on your work in Question 1, is the firm getting the most output possible from its given resource budget? If so, explain why. If not, how should it reallocate its budget between labor and capital?

3. Suppose the MPP values are as given in Question 1, but that the prices of labor and capital are \$10 and \$20, respectively. Is the firm now getting the most output possible from its resource budget? Explain.
4. A different firm has allocated its resource budget between labor and capital and is producing a given output level at the lowest possible total cost. The MPP of labor is 25 units, and the MPP of capital is 20 units. If the price of a unit of labor is \$100, what is the price of a unit of capital?

Part B: The Profit-Maximizing Combination of Resources

The economic efficiency condition in Part A is what economists call a “necessary but not sufficient” condition for profit maximization. In other words, if a firm is not using an economically efficient (least-cost) combination of resources, then it cannot possibly be maximizing its total profit. If it is using an economically efficient combination, then it might be profit maximizing, but an additional condition must be satisfied to guarantee that is the case.

Here is the profit-maximizing condition for a combination of two resources:

$$\frac{MRP_L}{MRC_L} = \frac{MRP_K}{MRC_K} = 1.$$

If the resource markets are perfectly competitive, the condition can be written as

$$\frac{MRP_L}{P_L} = \frac{MRP_K}{P_K} = 1.$$

While this condition looks similar to the one in Part A, there are two significant differences.

1. The firm is comparing MRP, not MPP, to MRC.
2. The two ratios must both be equal to 1.

The second difference means the MRP from the last unit of each resource must be equal to its MRC. If the MRP of a unit of labor is greater than its MRC, the firm should hire more labor. If the MRP of a unit of capital is less than its MRC, the firm should get rid of some capital. (This is the rule we used in Activity 4-1 to find the profit-maximizing amount of labor in the short run when capital was fixed: Hire the amount of labor where $MRP = MCL$.)

5. Suppose the Ebbets Company produces 1,000 units of output with a combination of labor and capital such that the MRP of labor is \$30 and the MRP of capital is \$40. If this firm is maximizing its total profit at this output, what are the prices of units of labor and capital? (Assume the firm buys resources in perfectly competitive markets.)

6. The Shibe Company produces 800 units of output per period. The MRP of labor is \$60, and the MRP of capital is \$40. The market prices of units of labor and capital are \$12 and \$8, respectively. Is this firm maximizing its total profit? Explain.

7. The Honus Company currently produces Q_1 units of output each period. It sells its good in a perfectly competitive product market and buys its resources in perfectly competitive factor markets. The MPP of labor is 50 units, and the MPP of capital is 80 units. The prices it pays for units of labor and capital are \$100 and \$160, respectively.
 - (A) Is the company operating in an economically efficient manner? Explain.

 - (B) What would the market price of its good have to be for the firm to be maximizing its total profit?

The least-cost and profit-maximization conditions also apply to a firm with more than two resources (W, X, and Y).

Least-cost combination:
$$\frac{MPP_W}{MRC_W} = \frac{MPP_X}{MRC_X} = \frac{MPP_Y}{MRC_Y}.$$

Profit-maximization combination:
$$\frac{MRP_W}{MRC_W} = \frac{MRP_X}{MRC_X} = \frac{MRP_Y}{MRC_Y} = 1.$$

The Only Game in Town

In Activity 4-1, we assumed the Acme Yo-Yo Company sold its product in a perfectly competitive market. Acme could sell all the yo-yos it wanted at the price determined in the market. Now, let's suppose that Acme is a monopolist and controls the yo-yo market. Because it still hires its workers in a perfectly competitive labor market, we will continue to treat its marginal revenue product (MRP) curve as its demand for labor (L). It can hire all the workers it wants at the market wage rate.

What is different in our analysis if Acme is a monopolist in the product market rather than a perfectly competitive seller of yo-yos? The difference is that now the firm must lower its price to sell more yo-yos. That will create a wedge between its price and the marginal revenue it receives from an extra sold unit. And it will make the workers' MRP decrease faster than it did when the firm was perfectly competitive. Now there are two reasons why MRP decreases as more workers are hired: diminishing marginal productivity and diminishing marginal revenue.

Part A: Creating the Monopolist's Demand for Labor

1. Complete Table 4-3.1, which shows the prices at which the Acme monopolist can sell the different quantities of yo-yos it is producing. You can see that the firm must lower the price to sell more of its product. The productivity data are the same as they were in Activity 4-1; the fact that the firm now has no competition in the product market does not affect the productivity of workers.


 **Student Alert:** You cannot find the MRP of a worker by multiplying the marginal physical product (MPP) by the price (P). That worked in Activity 4-1 because the firm sold its output (Q) at the market price. But now the firm is a monopolist and must lower price to sell more output. MRP is found here as the change in total revenue (TR) when the firm adds an extra worker.



Table 4-3.1

Productivity and Revenue Data for Yo-Yo Workers

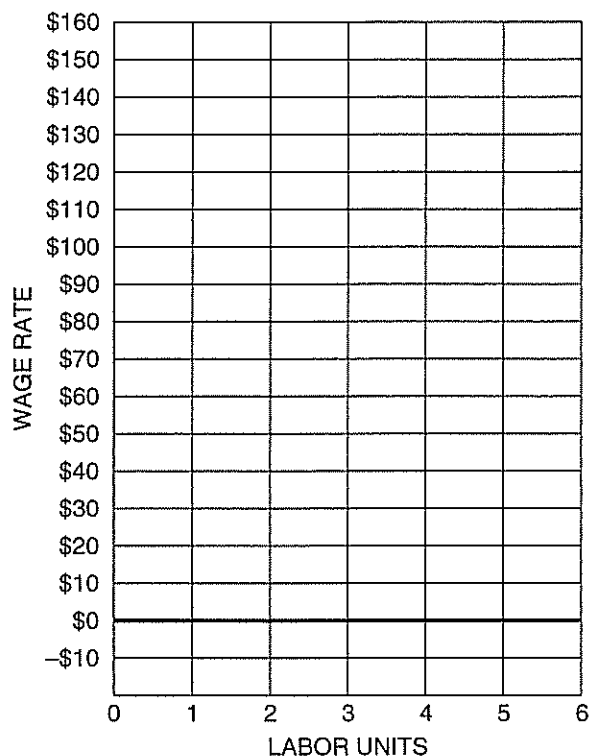
L (workers per day)	Q (yo-yos per day)	MPP	P	TR	MRP
0	0	—	\$8.00	\$0	—
1	20		\$7.25		
2	50	+30	\$6.00		+\$155.00
3	70		\$5.25		
4	85		\$4.70	\$399.50	
5	95	+10	\$4.30		+\$9.00
6	100		\$4.00		

- Plot the firm's MRP data in Figure 4-3.1. Connect the MRP values and label the curve as "D = MRP." Plot the MRP values at the new labor amount rather than at the midpoint.



Figure 4-3.1

The Acme Firm's Demand for Labor and Supply of Labor



- Draw three horizontal labor supply curves in Figure 4-3.1 at wages of \$120, \$60, and \$30. Label them as " $S_1 = MRC_1$," " $S_2 = MRC_2$," and " $S_3 = MRC_3$."
- Complete Table 4-3.2, which shows how many workers the firm will hire at each of these wages.



Table 4-3.2

Acme's Demand for Labor

Wage	Number of workers hired
\$120	
\$60	
\$30	

5. Does the law of demand apply to this firm, which is a monopolist in the product market?
6. Why can we consider the firm's MRP curve as its labor demand curve? Is it important that the labor market is perfectly competitive? Is it important that the product market is not perfectly competitive?
7. Other things being equal, would Acme's demand curve for labor be steeper or flatter now than it was when it was in a perfectly competitive goods market? Why?

Factor Market Pricing

A perfectly competitive labor market determines the equilibrium wage and employment in that market. Firms that buy labor in this market will pay the market wage and can hire all the workers they want at this wage. This activity demonstrates how the market wage is set and how a firm interacts with the labor market.

Part A: Labor Demand for the Perfectly Competitive Firm

The Awesome Belt Company (ABC) is a price taker in both the input and output markets. It hires labor in a perfectly competitive resource market and sells its belts in a perfectly competitive product market. The total revenue (TR) the firm receives from each amount of labor is found by multiplying output (Q) by the price (P) at which that level of output can be sold. The marginal revenue product (MRP) of an extra unit of labor is the change in TR resulting from the firm adding the extra labor unit.

1. Complete Table 4-4.1 based on two different possible prices for ABC's belts.



Table 4-4.1

ABC's Productivity and Revenue Data

Labor (L)	Output (Q)	Marginal physical product (MPP) ($\Delta Q/\Delta L$)	Price = \$2.00		Price = \$3.00	
			TR	MRP	TR	MRP
0	0	—	\$0	—		—
1	10	+10		+\$20		
2	30	+20	\$60			
3	70				\$210	
4	105					+\$105
5	135		\$270	+\$60		
6	160				\$480	
7	180	+20		+\$40		+\$60
8	195		\$390		\$585	
9	205	+10				+\$30
10	205	+0				+\$0
11	195		\$390	-\$20		

2. Now complete Table 4-4.2 and Table 4-4.3, which show ABC's demand for labor at two different prices of belts. The demand schedules indicate the highest wage the firm will pay for a given number of workers, based on the MRP of workers in Table 4-4.1.



Table 4-4.2

ABC's Demand for Labor if the Price of Belts Is \$2.00

Wage	Quantity of labor demanded
\$20	
\$30	
\$40	
\$50	
\$60	
\$70	
\$80	



Table 4-4.3

ABC's Demand for Labor if the Price of Belts Is \$3.00

Wage	Quantity of labor demanded
\$30	
\$45	
\$60	
\$75	
\$90	
\$105	
\$120	

Part B: The Perfectly Competitive Labor Market

3. Assuming there are 1,000 firms identical to ABC in the belt industry, complete Table 4-4.4, based on the market price of belts being \$2.00. Since the firms are identical, you can simply multiply the quantity of labor demanded by ABC at the different wages by 1,000 to derive the market demand for labor. Table 4-4.4 also has information about the number of workers willing to supply their labor at the different wages. Comparing the quantity of workers demanded and the quantity supplied, indicate whether there is a shortage or a surplus of labor at each wage. One wage is the equilibrium wage in the market.



Table 4-4.4

The Labor Market Based on the Price of Belts Being \$2.00

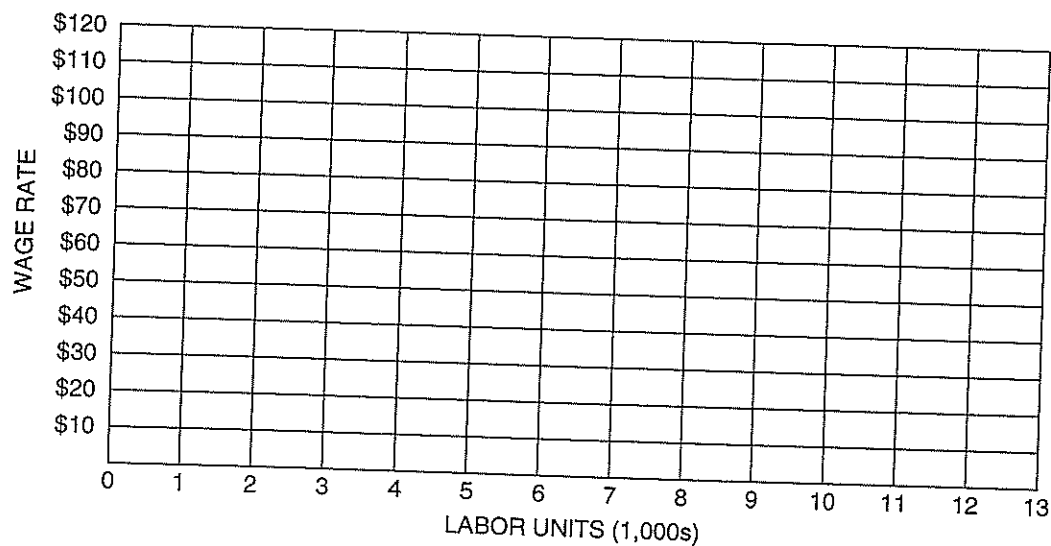
Wage	Quantity of labor demanded	Quantity of labor supplied	State of the labor market
\$20		3,000	Shortage / Equilibrium / Surplus
\$30		4,000	Shortage / Equilibrium / Surplus
\$40		5,000	Shortage / Equilibrium / Surplus
\$50		6,000	Shortage / Equilibrium / Surplus
\$60		7,000	Shortage / Equilibrium / Surplus
\$70		8,000	Shortage / Equilibrium / Surplus
\$80		9,000	Shortage / Equilibrium / Surplus

4. In Figure 4-4.1, plot the market demand and supply curves for labor from Table 4-4.4. Label the demand curve as " $D_{\$2.00}$ " and the supply curve as "S".



Figure 4-4.1

The Labor Market



5. Why is the market demand curve for labor downward sloping? Why is the market supply curve of labor upward sloping?

6. Assume the wage is at some level greater than the equilibrium wage. Is there a shortage or surplus of labor? What adjustments take place in the market to move the wage to the equilibrium wage?
7. Assume the wage is at some level less than the equilibrium wage. Is there a shortage or surplus of labor? What adjustments take place in the market to move the wage to the equilibrium wage?
8. Assuming there are 1,000 firms identical to ABC in the belt industry, complete Table 4-4.5, based on the market price of belts being \$3.00.



Table 4-4.5

The Labor Market Based on the Price of Belts Being \$3.00

Wage	Quantity of labor demanded	Quantity of labor supplied*	State of the labor market
\$30		4,000	Shortage / Equilibrium / Surplus
\$45		4,500	Shortage / Equilibrium / Surplus
\$60		7,000	Shortage / Equilibrium / Surplus
\$75		8,000	Shortage / Equilibrium / Surplus
\$90		10,000	Shortage / Equilibrium / Surplus
\$105		11,500	Shortage / Equilibrium / Surplus
\$120		13,000	Shortage / Equilibrium / Surplus

*Some of the quantity supplied figures are interpolated from the supply data in Table 4-4.4.

9. In Figure 4-4.1, plot the market demand curve for labor from Table 4-4.5. Label the demand curve as " $D_{\$3.00}$." (The supply curve is the same as in Table 4-4.4.)
10. Why did the market demand curve for labor shift to the right when the price of belts increased from \$2.00 to \$3.00?

11. What happened to the equilibrium wage and the equilibrium quantity of labor when the labor demand curve shifted to the right?

Part C: The Perfectly Competitive Labor Market and a Firm's Demand for Labor

A perfectly competitive employer takes the market wage and can hire all the labor it wants at that wage. The firm does not have to raise its wage to attract more workers. The labor supply curve for the firm is horizontal at the market wage. This supply curve is perfectly elastic. If the firm drops its wage below the equilibrium wage, it will not be able to hire any workers.



Figure 4-4.2

The Labor Market and a Typical Firm in That Market

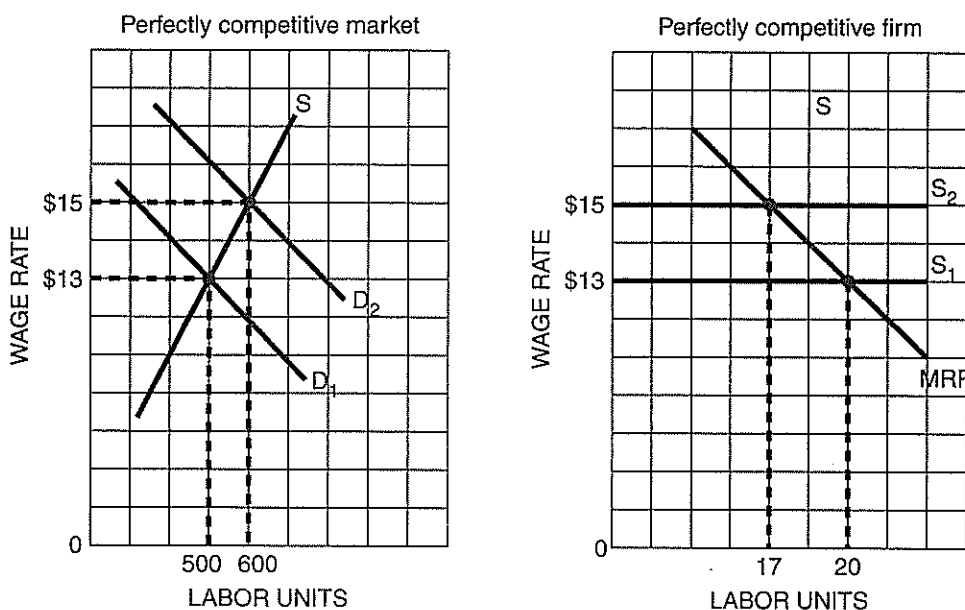


Figure 4-4.2 shows the competitive labor market and a typical firm that buys labor in that market. Answer the following questions based on this graph.

12. If the market demand for labor is D_1 , the equilibrium wage will be \$_____ and the equilibrium quantity of labor will be _____ workers.
13. How many workers will the firm hire at this market wage? _____

14. If the market demand for labor increases to D_2 , the market wage will increase to \$_____ and the equilibrium number of workers will increase to _____.
15. How many workers will the firm hire at this new market wage? _____
16. When the market wage increased, did the firm hire more or fewer workers? Why?
17. Is the firm's MRP curve also its demand curve for labor? Explain.
18. Are the workers in this market demanded exclusively by firms that produce the identical good, or are they hired by firms that make a variety of different goods?

How Wages Are Determined in Labor Markets

This activity examines how wages and employment are determined in two types of labor markets. A *perfectly competitive labor market* is one in which all buyers and sellers are so small that no one can act alone and affect the market wage. The interaction of market demand (D) and supply (S) determines the wage and the level of employment. A *monopsony* exists if there is only one buyer of labor in the resource market. The monopsonist pays as low a wage as possible to attract the number of workers needed.

Student Alert: If the monopsonist needs more workers, the wage will have to be raised.

Part A: A Perfectly Competitive Labor Market



Figure 4-5.1
A Perfectly Competitive Labor Market

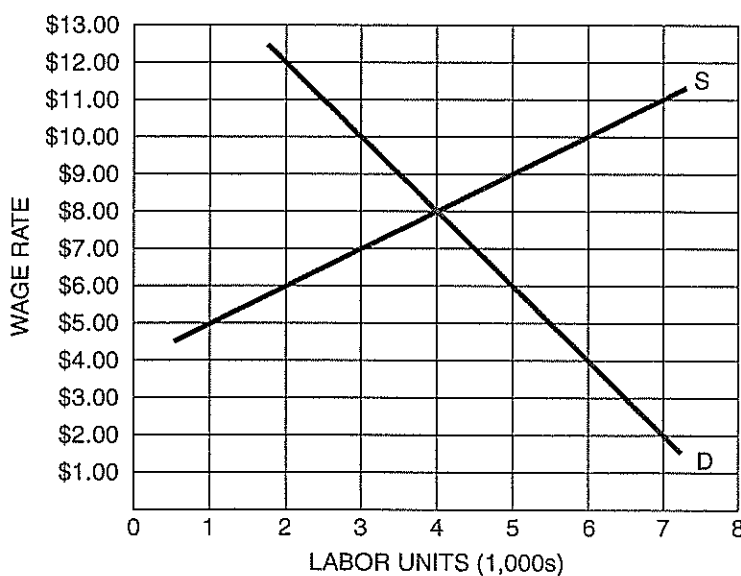


Figure 4-5.1 illustrates a perfectly competitive labor market. Labor is measured in thousands of labor hours. Answer the following questions based on this graph.

1. What are the equilibrium wage and number of labor hours in this labor market?
2. Why is the demand for labor downward sloping?

3. Why is the supply of labor upward sloping?

Part B: A Minimum Wage

4. Why does the government create a minimum wage in a labor market?
5. If the government sets a minimum wage of \$10.00 in the labor market shown in Figure 4-5.1, will there be a shortage or surplus of labor? How large is this shortage or surplus? Indicate this on the graph at the wage of \$10.00.
6. Are some workers made better off because of the minimum wage? Are some workers made worse off because of it? Explain.
7. Would skilled or unskilled workers be more likely to lose their jobs because of a minimum wage law?
8. If the demand for labor were more inelastic, would more or fewer workers lose their jobs because of the minimum wage? Explain.

Part C: A Monopsonistic Labor Market

Assume the Ross Textile Company is a monopsony in a small town. Because it faces the upward sloping market supply of labor, Ross must raise its wage if it wants to increase the quantity supplied of workers. The company pays the same wage to all its employees, so if it increases the wage to attract another worker, the marginal resource cost of that worker is greater than the wage paid to the worker: $MRC > \text{Wage}$.

Student Alert: If the wage is raised to hire another worker, then $MRC > \text{Wage}$.

9. Table 4-5.1 shows the supply of labor to Ross. Complete the table.



Table 4-5.1

Labor Supply Schedule

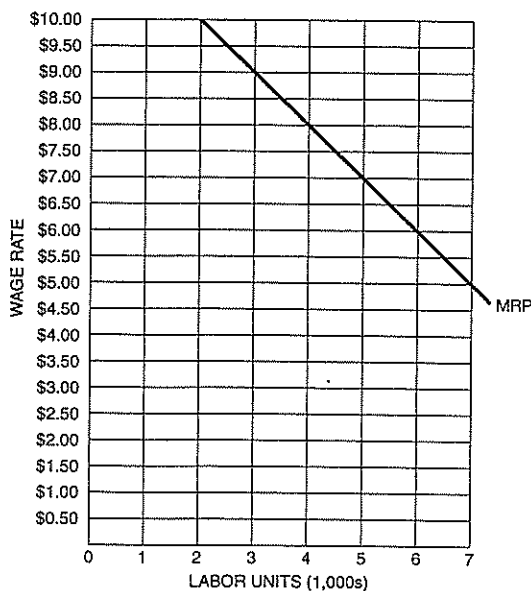
Workers	Wage	Total labor cost	Marginal resource cost
1	\$5.00	\$5.00	
2	\$5.50	\$11.00	\$6.00
3	\$6.00		
4	\$6.50		
5	\$7.00		\$9.00
6	\$7.50	\$45.00	

10. Plot the Ross Company's labor supply (S) curve and MRC curve in Figure 4-5.2. The firm's marginal revenue product (MRP) curve is already in the graph.



Figure 4-5.2

A Monopsonistic Labor Market



11. Why is the MRC curve above the S curve?
12. What is more important to Ross as it considers hiring another worker—the wage paid to the worker or the worker's MRC? Why?
13. How many workers will Ross hire? What wage will it pay to each of these workers?
14. Is the MRP curve the firm's D curve for labor?
15. What would be the equilibrium wage and employment if this were a perfectly competitive market? How do these values compare with those of the monopsonist?
16. If any firm hires the amount of labor at which $MRP = MRC$, is it also true that the firm is producing the output level at which $MR = MC$? Does the answer depend on whether the firm is perfectly competitive or monopolistic in the goods market, or whether it is perfectly competitive or monopsonistic in the labor market?

Wages and Employment in Competitive and Monopsonistic Labor Markets

This activity asks you to show how changes in economic conditions, government policy, and union activity affect different types of labor markets. The impact of such changes depends on the degree of competition on the demand and supply sides of the labor market. The symbols W_C , L_C , W_M , and L_M refer to the wages and labor in the competitive and monopsonistic labor markets. You are to consider the short-run effects in the specified labor market.

Part A: Perfect Competition and Monopsony



Figure 4-6.1

Perfectly Competitive and Monopsonistic Labor Markets

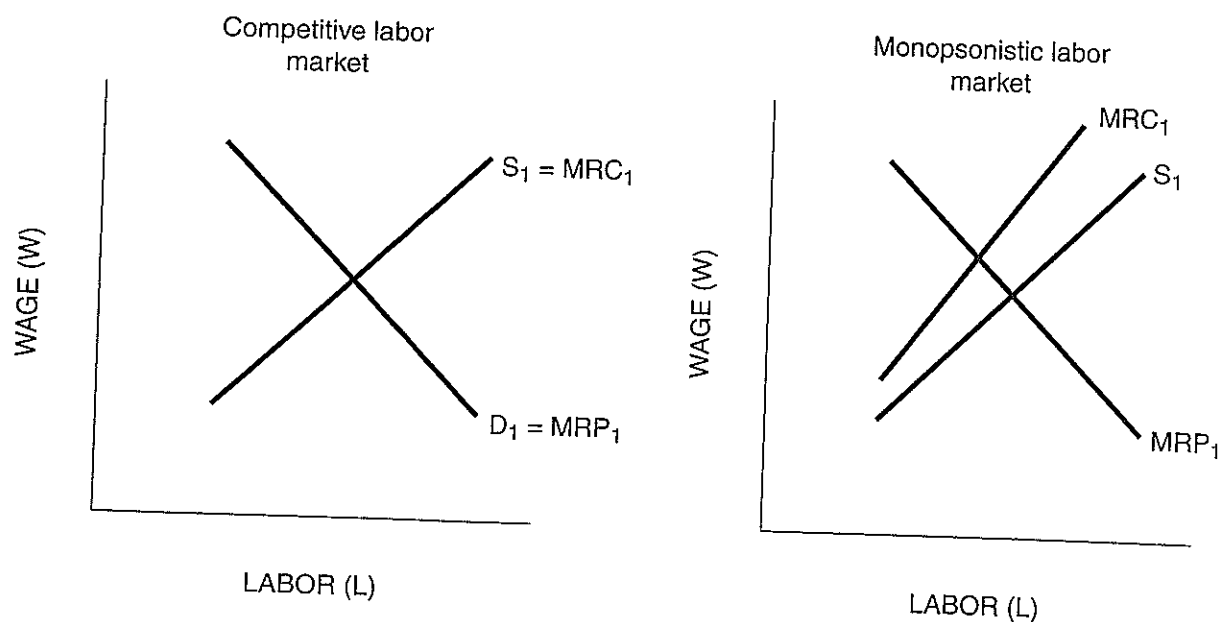


Figure 4-6.1 presents the basic setup of a perfectly competitive labor market and a monopsonistic labor market. Answer the following questions based on this figure.

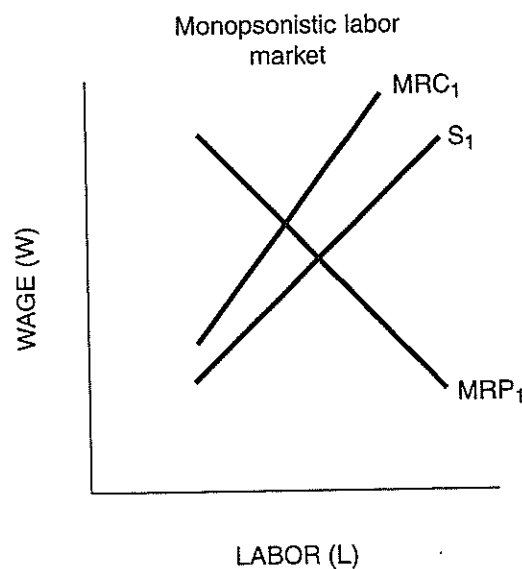
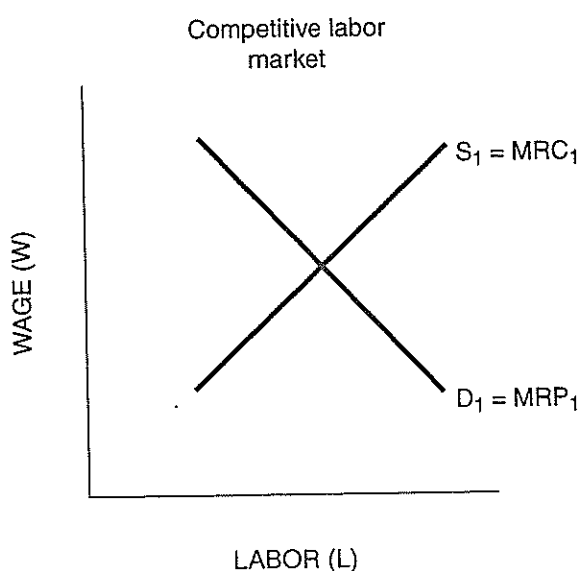
1. Why is the marginal revenue product (MRP) curve equal to the market demand (D) curve for labor in the perfectly competitive labor market?
2. Why is the MRP curve not equal to the market D curve for labor in the monopsonistic labor market?

3. Why is the marginal resource cost (MRC) curve equal to the market labor supply (S) curve in the perfectly competitive labor market?
4. Why is the MRC curve not equal to the market labor S curve in the monopsonistic labor market?
5. In the appropriate graph, indicate by W_{C1} and L_{C1} , or W_{M1} and L_{M1} , the market wage and quantity of labor.

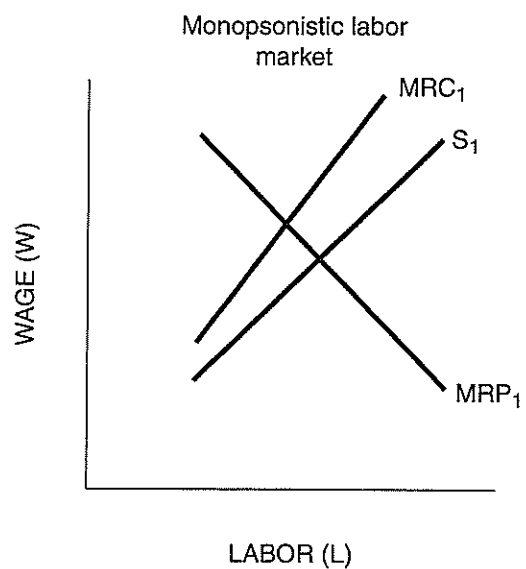
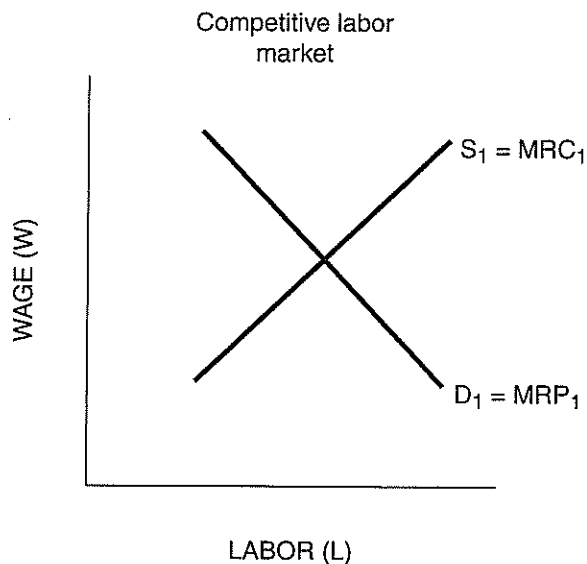
Part B: Analyzing Changes in the Labor Market

For each of the following scenarios, analyze the short-run effect of the specified event on each labor market. In the perfectly competitive labor market graph, indicate by W_{C1} and W_{C2} the market wage before and after the event. Indicate by L_{C1} and L_{C2} the equilibrium quantity of labor before and after the event. In the monopsonistic labor market graph, indicate by W_{M1} and W_{M2} the market wage before and after the event. Indicate by L_{M1} and L_{M2} the equilibrium quantity of labor before and after the event. State whether the event increases, decreases, or does not change the market wage and labor. Be sure to shift the curves that are affected by the events, leading to the changes in wage and labor.

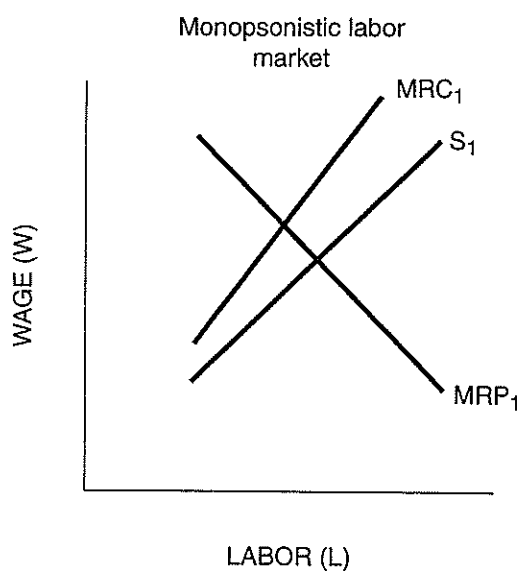
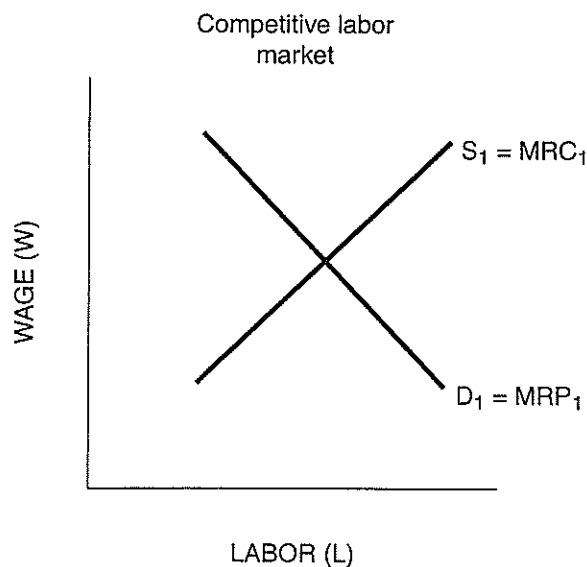
6. Event: The state passes legislation requiring new teachers to pass a competency test in order to be employed by any school in the state. (The graphs refer to the labor market for teachers.)



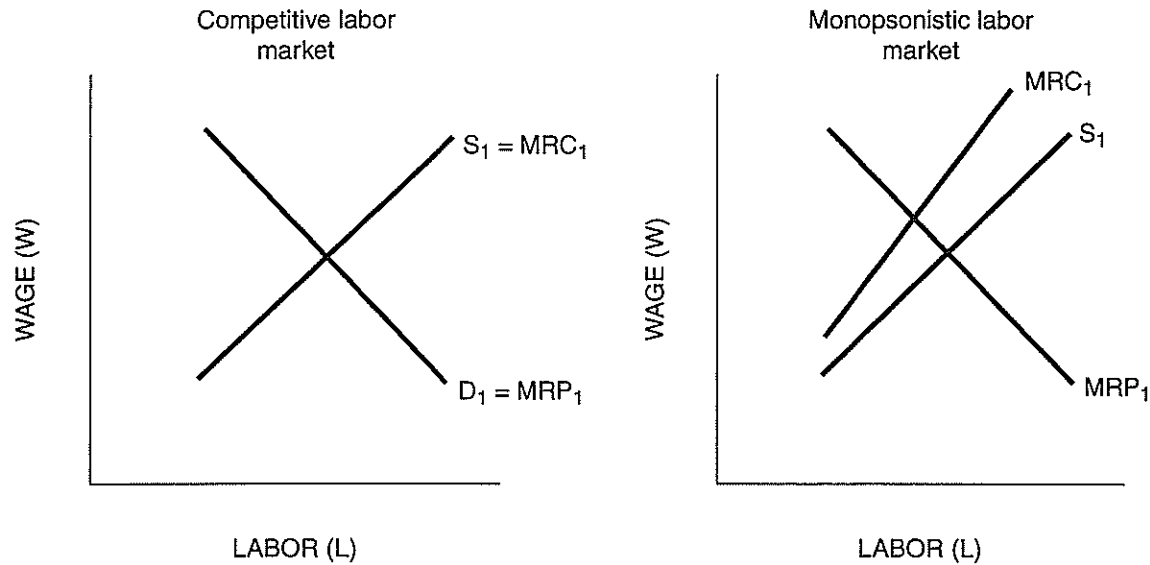
7. Event: New training methods increase the productivity of workers in the automobile industry. (The graphs refer to the labor market for automobile workers.)



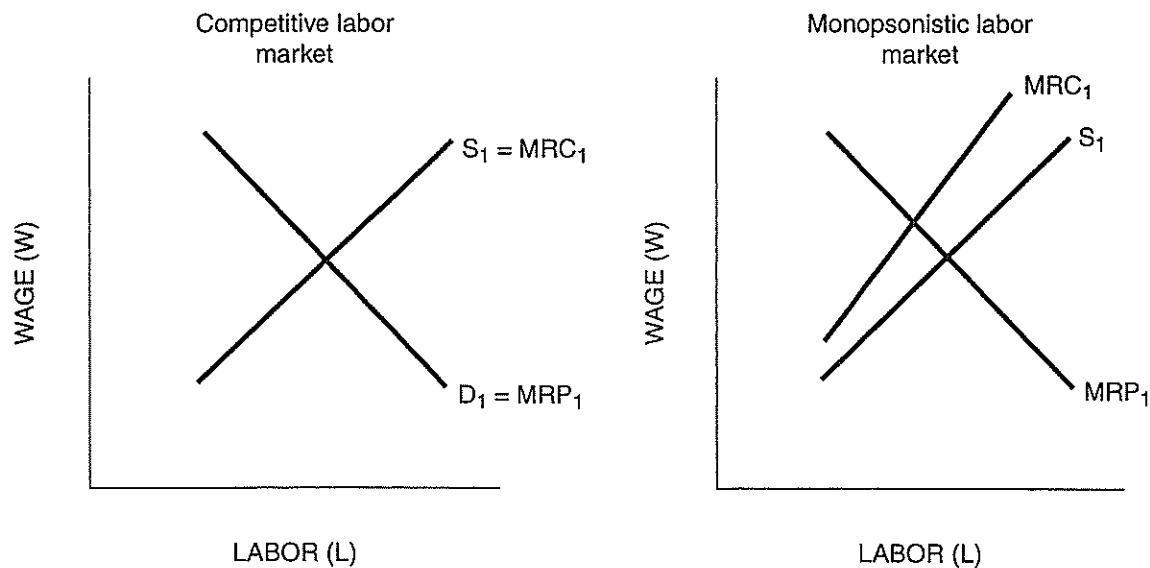
8. Event: The U.S. government relaxes a tough immigration law, making it easier for construction workers from other countries to enter the United States. (The graphs refer to the American labor market for construction workers.)



9. Event: The German government lowers tariffs on shoes imported into Germany. (The graphs refer to the labor market for shoe workers in Germany.)



10. Event: Labor unions conduct a successful advertising campaign urging people to buy goods and services produced by American workers. (The graphs refer to the labor market for all American workers.)



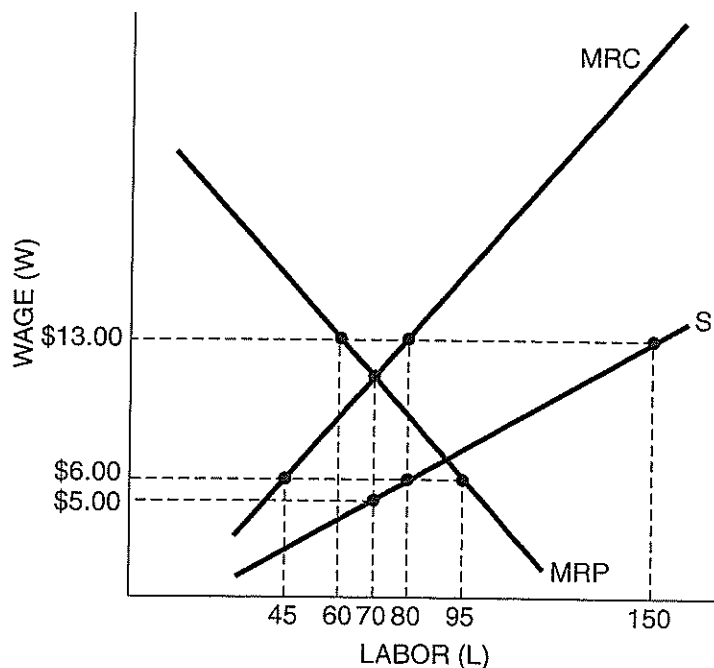
Part B: Monopsony and a Minimum Wage

Figure 4-6.2 illustrates the labor market in which there is only one employer. This monopsonist sells its good in a perfectly competitive product market.



Figure 4-6.2

A Monopsonistic Labor Market



1. What is the profit-maximizing amount of labor for this monopsonistic firm? Why?
2. What wage will it pay each unit of labor? Why?
3. If the government sets a minimum wage of \$13.00, how many units of labor would be hired? How many units of labor will be unemployed with this minimum wage? Explain.
4. If the government sets a minimum wage of \$6.00, how many units of labor would be hired? How many units of labor will be unemployed with this minimum wage? Explain.

Problems Dealing with Factor Markets

Part A: Factor Market Questions

Answer the questions and briefly explain your answers. Feel free to use diagrams to illustrate your points.

1. Why are some basketball players paid more than brain surgeons? Explain using the concept of marginal revenue product.
2. True, false, or uncertain, and explain why? "If it were not for unions pushing up wages, we'd all be working 60 hours a week for \$100 a month just like people did a century ago."
3. Use a graph to explain why a firm that wants to maximize its total profits uses a resource until the marginal revenue product of this resource equals the marginal resource cost.
4. True, false, or uncertain, and explain why? "American workers who are paid \$10 an hour cannot possibly compete with workers who are paid \$1 an hour in developing countries."

Part B: How Many Workers to Hire?

Table 4-7.1 gives you information about a firm operating in a perfectly competitive product market. Consider all factors of production fixed, with the exception of labor. The other factors of production cost the firm \$50 a day, which may be thought of as the firm's total fixed cost. Assume the firm is a profit maximizer.



Table 4-7.1

Firm Operating in a Competitive Product Market

Labor (L) (workers per day)	Output (Q) (units per day)	Marginal physical product (MPP)	Total revenue (TR)	Marginal revenue product (MRP)
0	0	—	\$0	—
1	22			
2	40	+18	\$120	+\$54
3	56			
4	70			
5	82	+12		+\$36
6	92		\$276	
7	100	+8	\$300	
8	106	+6	\$318	+\$18

5. Why might a university pay a Nobel Prize-winning faculty member more than its president? Does this make sense economically for the university? Support your answer.
6. What are the effects of a minimum wage that is above the equilibrium wage in a perfectly competitive market? What about in a market in which the employer is a monopsonist? Give an example of a relatively competitive labor market and a less competitive labor market.
7. The National Collegiate Athletic Association (NCAA) regulates all college athletics in the United States. It sets the amount of scholarships, the number of scholarships granted, and the regulations for recruiting athletes. The NCAA has hundreds of rules regulating intercollegiate athletics.
- (A) What effect do these regulations have on who receives the economic rent from college athletics?
- (B) Which colleges have greater incentives to cheat? Why?
- (C) Who would gain if the NCAA could no longer set rules for college athletics? Why?
- (D) Who would lose if the NCAA could no longer control college athletics? Why?
- (E) True, false, or uncertain, and why? "The NCAA is a champion for amateur athletics, and its rules protect the rights of college athletes."

Fill in the answer blanks or underline the correct words in parentheses.

8. Assume the firm sells its output at \$3 per unit. Complete Table 4-7.1.

(A) If the equilibrium market wage is \$36 per day, the firm will hire _____ workers per day and produce _____ units of output.

(B) Given your answer to the preceding question, the firm will have total revenue of _____ per day and total cost of _____ per day.

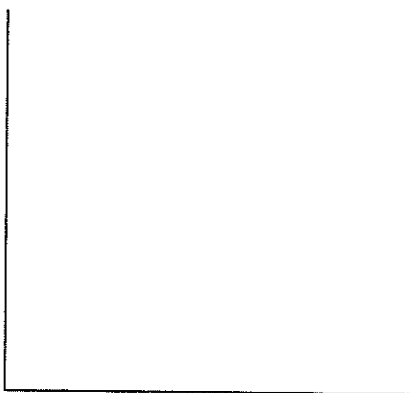
(C) The above will result in a (*profit / loss*) of _____ per day.

9. Suppose you work for a firm that sells its output in a monopolistic market. Answer the following questions.

(A) If you hire an additional worker, output goes up from 75 to 125 units per day. If you want to sell the additional 50 units, you must lower your price from \$3 per unit to \$2 per unit. What is the highest wage you would be willing to pay the additional worker?

(B) Assume that you hired the additional worker and output now stands at 125 units per day. If you hire another worker, output rises to 165 units per day. Given the demand curve for your product, you know that to sell the additional output, price will have to be dropped from \$2 per unit to \$1 per unit. What is the maximum wage you would be willing to pay *this* additional worker? Would you hire this additional worker? Why or why not?

10. Use a graph to explain why monopsonists will always hire fewer workers and pay lower wages than firms operating in competitive labor markets. (Assume that the monopsonistic and competitive firms have the same costs.)



4 Microeconomics

MULTIPLE-CHOICE SAMPLE QUESTIONS

Circle the letter of each correct answer.

1. Derived demand is
 - (A) demand for an input used to produce a product.
 - (B) demand derived from the satisfaction of a buyer for the product.
 - (C) caused by monopoly control of the inputs.
 - (D) derived from government policy.
 - (E) dependent on the demand for a substitute or a complementary input.

Use the following information to answer Questions 2, 3, and 4.

Number of chefs	Number of pizzas that can be made in an hour
0	0
1	10
2	18
3	24
4	28
5	30
6	29

2. The law of diminishing marginal returns occurs with the hiring of which chef?
 - (A) First
 - (B) Second
 - (C) Third
 - (D) Fourth
 - (E) Fifth
3. The marginal productivity of the third chef is
 - (A) 24 pizzas
 - (B) 18 pizzas
 - (C) 10 pizzas
 - (D) 8 pizzas
 - (E) 6 pizzas

4. If the price per pizza is \$10 and if each chef receives \$20 an hour, how many chefs will the owner hire to maximize total profits?
 - (A) 2
 - (B) 3
 - (C) 4
 - (D) 5
 - (E) 6
5. Which of the following would determine the marginal revenue product of an input used in a perfectly competitive output market?
 - I. Dividing the change in total revenue by the change in the input
 - II. Dividing the change in marginal revenue by the change in the output
 - III. Multiplying the marginal product by the price of the output
 - IV. Multiplying marginal revenue by the price of the output
 - (A) I only
 - (B) II only
 - (C) III only
 - (D) I and III only
 - (E) II and IV only
6. Which of the following explains why the marginal revenue product of an input in a perfectly competitive product market decreases as a firm increases the quantity of an input used?
 - (A) Diminishing marginal productivity from labor
 - (B) Diminishing marginal utility
 - (C) The homogeneity of the product
 - (D) The free mobility of resources
 - (E) Diminishing marginal revenue from output

4 Microeconomics

MULTIPLE-CHOICE SAMPLE QUESTIONS (CONTINUED)

7. A profit-maximizing firm should hire an input as long as the
- (A) firm can increase its total revenue.
 - (B) price of the input doesn't exceed the price of the other inputs used in the firm's production.
 - (C) marginal revenue product of the input is less than the cost of hiring the input.
 - (D) marginal revenue product of the input is greater than the marginal revenue products of other inputs the firm is using.
 - (E) marginal revenue product of the input is at least as much as the marginal cost of hiring the input.

8. The demand for labor will decrease in response to which of the following?

- (A) Increased productivity of labor
- (B) Better training of all laborers
- (C) A decrease in the supply of labor
- (D) An increase in the supply of labor
- (E) Decreased demand for goods and services produced by labor

9. A firm hiring inputs in a perfectly competitive market will hire up to the point where

- (A) marginal physical product of the input is at a minimum.
- (B) marginal physical product of the input is at a maximum.
- (C) the price of the input equals the price of the output.
- (D) the price of the input equals the marginal physical product of the input.
- (E) the price of the input equals the marginal revenue product of the input.

10. A firm is a competitive seller of output at a market price of \$3. The only resource it requires to create its product is labor, which it purchases competitively at a wage rate of \$8 per hour. The last worker it employs increases total output from 36 to 40 units per hour. What is the marginal revenue product for this worker?

- (A) \$3
- (B) \$4
- (C) \$8
- (D) \$12
- (E) \$24

Use the following information to answer Questions 11, 12, and 13.

Units of workers	Total product	Product price
0	0	\$5.00
1	10	\$4.50
2	19	\$4.00
3	27	\$3.50
4	34	\$3.00
5	40	\$2.50

11. The marginal revenue product of the third worker is equal to

- (A) \$3.50
- (B) \$10.50
- (C) \$18.50
- (D) \$28.00
- (E) \$94.50

12. Which of the following is true according to the information in the table?

- (A) The firm is selling its product in a purely competitive market.
- (B) The firm is selling its product in an imperfectly competitive market.
- (C) There is no level of output at which this firm can earn a profit.
- (D) The law of diminishing returns is not applicable to this firm.
- (E) The firm is hiring its workers in an imperfectly competitive labor market.

13. If the wage rate is constant and equal to \$21, how many workers will the profit-maximizing firm hire?

(A) 1 (D) 4
(B) 2 (E) 5
(C) 3

14. Which of the following will cause an increase in the demand for labor?

I. Increase in the price of the output
II. Increase in worker productivity
III. Increase in wages
IV. Increase in the supply of workers

(A) I only (D) I and II only
(B) II only (E) III and IV only
(C) III only

15. A firm requires labor and capital to produce a given output. Labor costs \$8 per hour, and capital costs \$12 per hour. At the current output level, the marginal physical product of labor is 40 units, and the marginal physical product of capital is 60 units. To minimize its production costs at the current level of output, in which of

the following ways should the firm change the amount of labor and capital?

Labor	Capital
(A) Increase	Increase
(B) Increase	Decrease
(C) Decrease	Increase
(D) Decrease	No change
(E) No change	No change

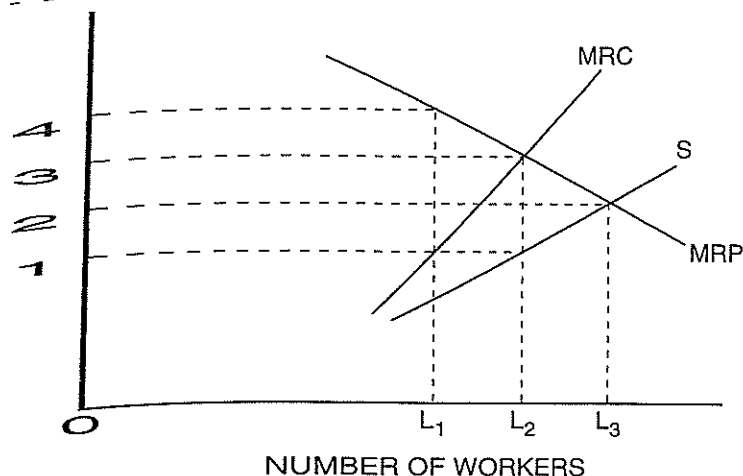
16. In a competitive industry, suppose the marginal revenue product of the last donut baker hired is \$35 and the marginal revenue product of the last bagel maker hired is \$15. A bakery must pay donut bakers \$40 a day and bagel makers \$10 a day. Which of the following should the bakery hire to maximize profits?

(A) More donut bakers and fewer bagel makers
(B) Fewer donut bakers and more bagel makers
(C) Fewer of both donut bakers and bagel makers
(D) More of both donut bakers and bagel makers
(E) Neither more nor fewer donut bakers or bagel makers

Microeconomics

MULTIPLE-CHOICE SAMPLE QUESTIONS (CONTINUED)

Use the graph below to answer Questions 17, 18, and 19.



Under perfectly competitive conditions in the product and labor markets, the wage rate will be

- A) W_1 , and L_2 workers will be hired.
- B) W_2 , and L_2 workers will be hired.
- C) W_3 , and L_2 workers will be hired.
- D) W_2 , and L_3 workers will be hired.
- E) W_4 , and L_2 workers will be hired.

Now suppose that through an employers' association, firms in this industry establish a monopsony in the hiring of labor. In this case, the wage rate will be

- A) W_1 , and L_2 workers will be hired.
- B) W_2 , and L_2 workers will be hired.
- C) W_3 , and L_2 workers will be hired.
- D) W_3 , and L_3 workers will be hired.
- E) W_4 , and L_1 workers will be hired.

Now assume that workers react to the formation of this monopsony by establishing a union. To what level can this union increase the

wage rate without causing the number of jobs to decline below that which the monopsony would otherwise provide?

- (A) W_1 (B) W_2 (C) W_3 (D) W_4
- (E) Unions can never increase real wage rates.

20. If the wage paid to labor, the only variable input, is \$20, and the marginal physical product of labor is four units per hour, the marginal cost of a unit of output is

- (A) \$20. (D) \$10.
- (B) \$16. (E) \$5.
- (C) \$12.

21. Pure economic rent refers to the

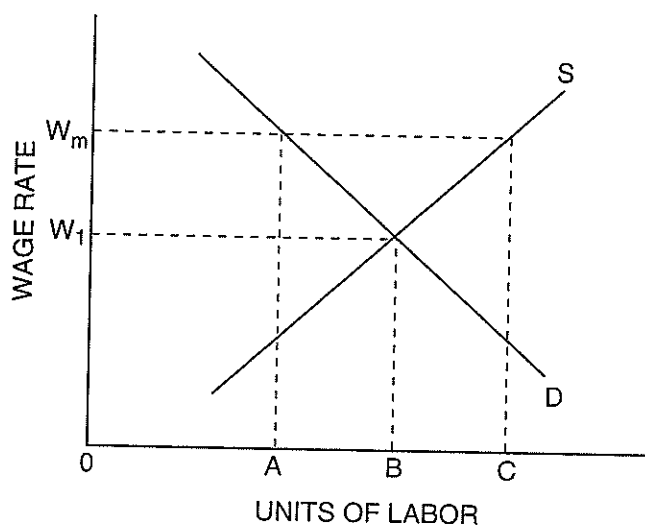
- (A) capital gains received from the sale of property.
- (B) payment to any resource over and above what is required to keep the resource in supply at its current level in the long run.
- (C) difference between the return to owners of land and the market rate of interest.
- (D) implicit value of owner-occupied housing in the long run.
- (E) price paid for a resource that has a perfectly elastic supply.

22. One reason why the supply of carpenters is greater than the supply of physicians is that

- (A) carpenters demand less income.
- (B) physicians do not belong to a union.
- (C) physicians must make a greater investment in human capital.
- (D) carpenters belong to unions.
- (E) carpenters are in greater demand than are doctors.

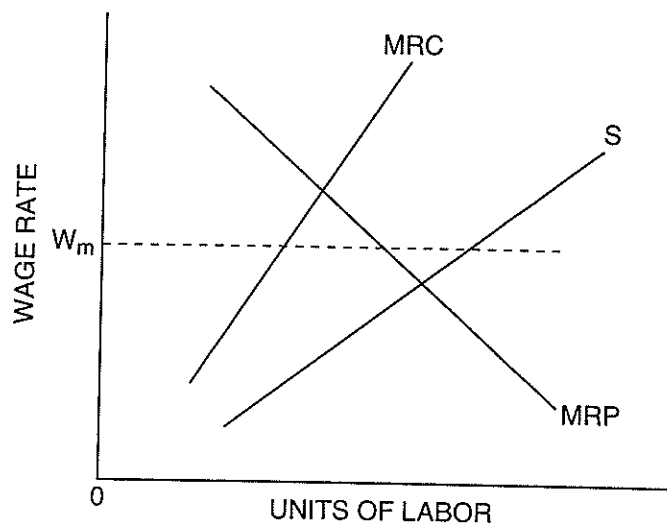
23. Under what conditions is a firm's marginal revenue product of labor curve the same thing as its demand curve for labor?

- (A) If the firm sells its output in a perfectly competitive product market
- (B) If the firm sells its output in an imperfectly competitive product market
- (C) If the firm hires labor in a perfectly competitive resource market
- (D) If the firm hires labor in an imperfectly competitive resource market
- (E) The marginal revenue product curve is never the same thing as a firm's demand curve for labor.



24. The competitive labor market shown above is initially in equilibrium. If a minimum wage level is set at W_m , employment will

- (A) increase from A to B.
- (B) increase from B to C.
- (C) decrease from B to A.
- (D) decrease from C to A.
- (E) decrease from C to B.



25. The monopsonistic labor market shown above is initially in equilibrium. If a minimum wage is set at W_m , the level of employment will

- (A) decrease.
- (B) increase.
- (C) stay the same.
- (D) increase or decrease depending on how the supply curve shifts as a result of the change in the wage rate.
- (E) be indeterminant under monopsonistic labor markets.